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(54) Set of telescopic boring rods with automatic coupling racks designed to transmit axial forces in both directions and with blocking elements of contiguous rods.

(57) The invention at reference concerns a set of telescopic boring rods with automatic coupling racks, designed to transmit axial forces in both directions and with blocking elements consisting of adjoining rods. It is possible to transmit the entire axial thrust due to the particular shape of the teeth on the racks applied to the rods, these teeth having some horizontal sections.

The possibility of blocking one or more adjoining rods allows the set to be extracted without using other means, even if the cable breaks, and allows holes of a smaller diameter than the most exterior rod to be made.

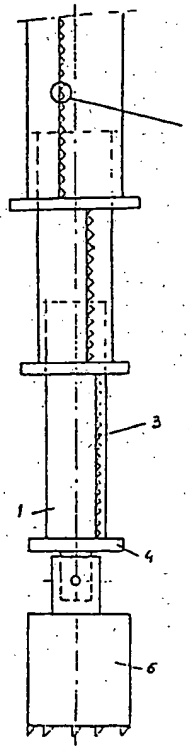

FIG. 1

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set of telescopic boring rods with automatic coupling racks designed to transmit axial forces in both directions and with blocking elements of contiguous rods

In dry boring for the construction of foundation poles, draining shafts or water wells or in any case, boring for the removal of dry waste, at the present time machines with a set of telescopic rods are used.

The machines used previously to carry out this operation have a head which is able to make the telescopic rods rotate and which induce onto the latter a torque and axial thrust during the drilling phase.

Moreover, they have one or more winches which group the set of telescopic rods together during the discharging phase. The difficulty encountered in the manufacture of machines with a set of telescopic rods is that of creating a set of rods, which, during the working phase, is such that all the elements making up the set are coupled, so as to transmit an axial thrust and torque, while during the collecting phase of the set (discharge phase), they are free to move longitudinally. Considerable improvement has been obtained by the set proposed in the patent application N° 44001A/83, filed at the Patent Office U.P.I.C.A. Pesaro on the 11th of January 1983, under file statement N° 1022, by the Company I.M.T. Srl itself, for which the patent N° 1172783 was issued. This patent included a rack with teeth of a generic shape designed to improve the coupling of the individual elements.

Through the experience gained from the production and use of the machine, which nevertheless is a considerable improvement in comparision with the competition, it was observed that in particular circumstances, while in use, the machine creates some difficulties. These occur mainly in two cases :

The first is due to the fact that during the boring phase, a layer of loose material may gather underneath the implement, which gets in between the teeth of the implement and the solid ground to be drilled. Because of the presence of water in the ground, in between said layer and the solid ground to be drilled, a fluid film is created, which causes the implement to slip, without enabling it to create a torque reaction on the rods. This phenomenon is the so-called " cushion " phenomenon and as such, does not allow boring to continue, in as much as, the torque necessary to block the rods is not present and so, these rods slip when axial force is applied, thereby adversely affecting the advancing motion of the implement.

The second problem occurs when the cable which collects the rods breaks. In this case, recovery of the rods is extremely dangerous and it is normally necessary to have the assistance of other machines, such as tracked cranes or diggers or the like.

In the invention at reference, these problems have been eliminated by means of the particular conformation of the racks applied to the rods, which, to this end, have shaped teeth with horizontal sections. Moreover, to avoid the separation of these teeth, contrasting elements have been provided, which can be inserted when necessary, into the end flanges of the rods through the slots provided for the purpose. The solutions adopted also enable holes to be made with a smaller diameter than the external rod, which previously was not possible.

The invention is now described in detail, with the help os the attached drawings, which represent one of the possible construction embodiments for illustrative purposes only. In the examples, three racks are used but obviously, it is possible to use one, two, four or more racks.

- Fig.1 represents a part of the set of rods in the working position.
- Fig.2 represents an enlarged detail of one of the racks applied to the rods.
- Fig.3 represents a transversal section of one of the rod elements.
- Fig.4, table 2 represents a transversal section of the rods during the working phase.
- Fig.5 represents a detail of two coupled racks during the working phase.
- Fig.6 represents a transversal section of the set of rods with the teeth on the racks disengaged.
- Fig.7 represents two uncoupled segments of the rack.
- Fig.8, table 3, shows a view seen from above, of one of the flanges, applied to the end of each element.
- Fig.9 represents two generic rods sectioned transversally, with a contrasting element inserted.
- Fig.10 represents a segment of coupled racks with a contrasting element inserted.

The set of telescopic rods, Fig.1, is made up of a series of concentric coaxial tubes, the diameter of which progressively decreases from the most exterior tube to the most interior tube.

Each element making up the set of rods, Fig.3, consists of a tube (1), on the outer side of which, there are three racks (3), positioned at 120° along the entire length of the tube. On the inside, there are three segments of rack (2), also positioned at

120°.

On the end part of each rod there is a flange (4), Fig.1 and 8, on which three slots have been made. The position of the external and internal racks is such, that, when the most exterior rod (9), Fig. 4, is rotated clockwise (which is normal during drilling), the internal teeth (7) couple up with the external teeth (8) of the rod (10), which is concentrical to it. The teeth would therefore be engaged as indicated in Fig. 5.

The rod, (9), while continuing to rotate clockwise, also draws the rod (10) concentrical to it, which will also cause the teeth(11)and (12) of rod (13) to couple up. Therefore, when the set of rods is rotated clockwise, after a partial turn, all the elements making up the set of rods are drawn into the rotation movement and moreover, simultaneously all the teeth of all the elements are engaged.

In short, during the drilling phase at any depth, the torque applied to the last rod is also transmitted to the implement (6), which is an integral part of the most interior rod and the geometric detail of the rack, with teeth at horizontal intermediate sections, allows axial thrust and pull loads to be transmitted to the implement, during said phase.

Therefore, even when the " cushion " effect is present, the advancing motion of the implement is guaranteed, maintaining the normal productivity standards of the entire drilling complex.

When the rod (9) is rotated anti-clockwise (normally the opposite when drilling), Fig. 6, the internal teeth move away from the external teeth (7) until the edge (14) touches the back of the rack (8) and the teeth are positioned as in Fig.7.

At this stage, the rod (9) also draws the rod (10) and by the same procedure disengages the teeth (11) from the teeth (12). While rotation continues, all the teeth of all the rods will eventually be disengaged, in these conditions, the set of rods is still able to transmit torque to the implement but the rods are free to move in the axial direction. In these working conditions, the axial loads which can be transmitted are small, but in any case in proportion to the friction of the elements in contact with each other and to the resisting torque, which is created on the implement.

In Fig. 1 two generic rods are represented.

On the flanges (4) welded to the individual elements of the set of rods, there are slots (5), Fig.8, so that, when the external teeth (17) of a tube, are engaged with the internal teeth (18) of the concentric tube, Fig.9, it is possible to insert an element (16), which acts as a contrasting element, and stops the teeth (17) and (18) from disengaging, as is indicated in Fig.10. Therefore, even when the cable which groups the rods together, breaks, it is possible to recover the rods without the assistance of cranes or similar machines, in a relatively short space of time.

The profile of the teeth on the racks could also be different from the one shown for illustrative purposes only, for example, it could be rectangular in shape, and still be within the scope of the instant invention.

Claims

1a) Set of telescopic boring rods with automatic coupling racks, designed to transmit axial forces in both directions and with blocking elements, consisting of adjoining rods, characterised by the fact that the racks applied to the outside and the inside of the telescopic rods, have teeth of a special shape, with horizontal sections which allow the entire axial thrust applied to the most exterior rod, to be transmitted to the implement, even if the reaction torque is very small;

2a) Set of telescospic rods as per the first claim, characterised by the fact that all the elements in the set have end flanges with slots which allow contrasting elements to be introduced, thereby stopping the teeth from disengaging and making it possible to recover the rods easily, even if the collecting cable breaks;

3a) Set of telescopic rods, according to the previous claims, characterised by the fact that the end flanges of the elements, are of diameters which progressively decrease, thereby making it possible for holes to be made of a smaller diameter than the most exterior rod, and to block two or more rods by means of the contrasting elements, which is also a result of the possibility of blocking the teeth with the contrasting elements as per claim 2a).

TAV. 1

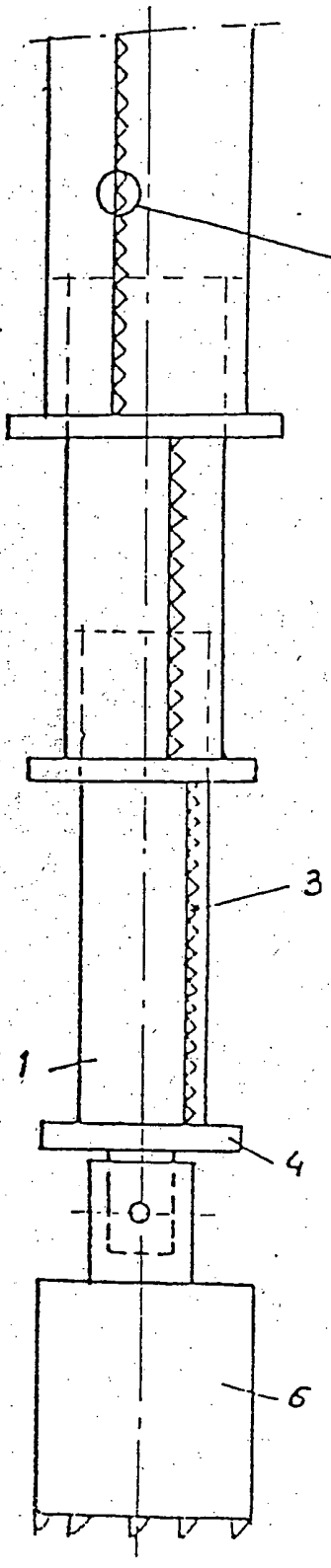

FIG. 1

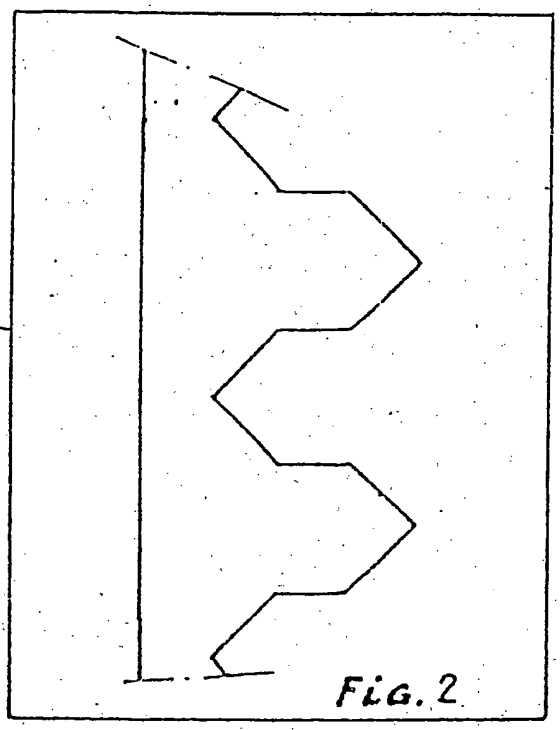

FIG. 2

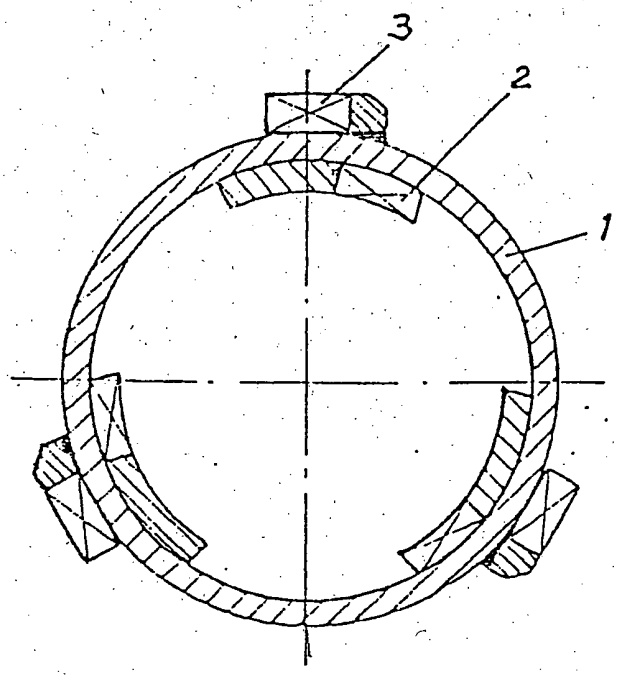

FIG. 3

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TAV. 2

FIG. 5

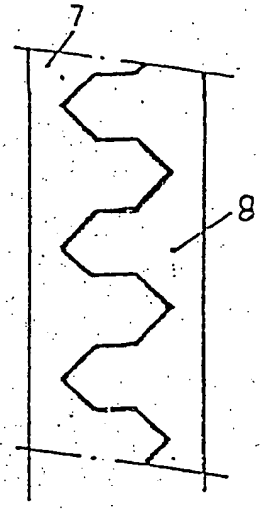


FIG. 4

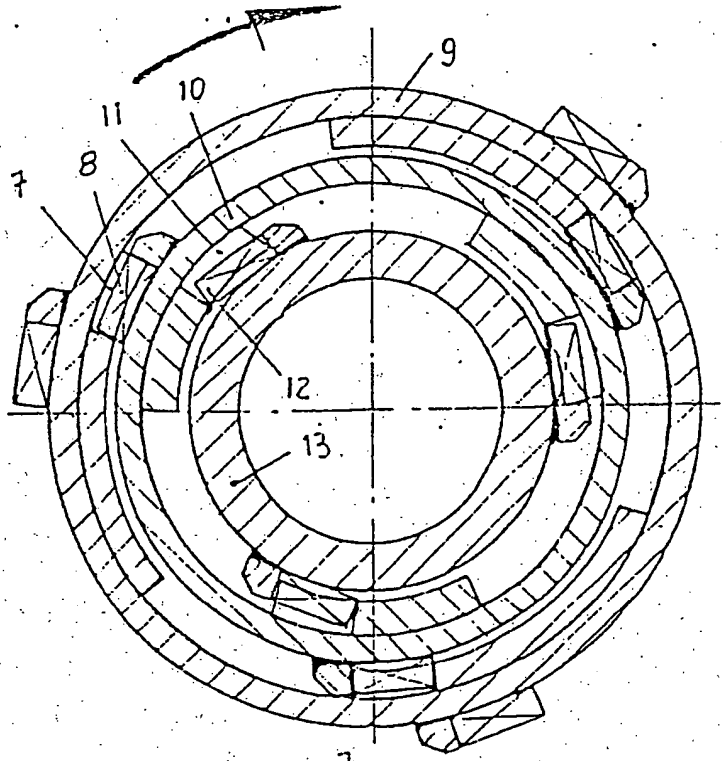
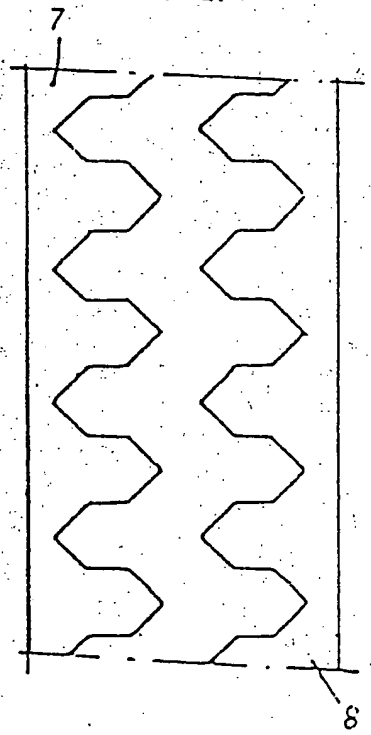


FIG. 7



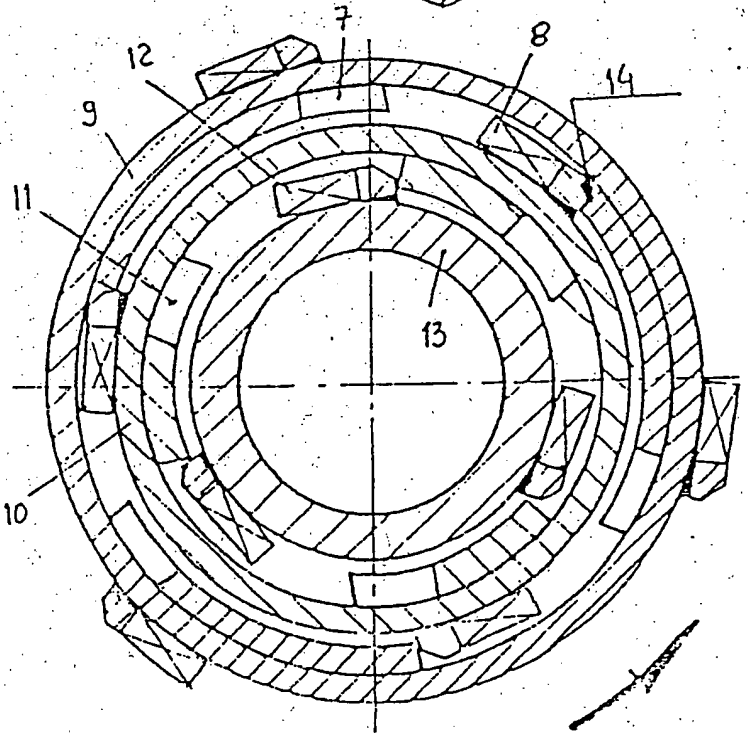


FIG. 6

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TAV. 3

FIG. 8

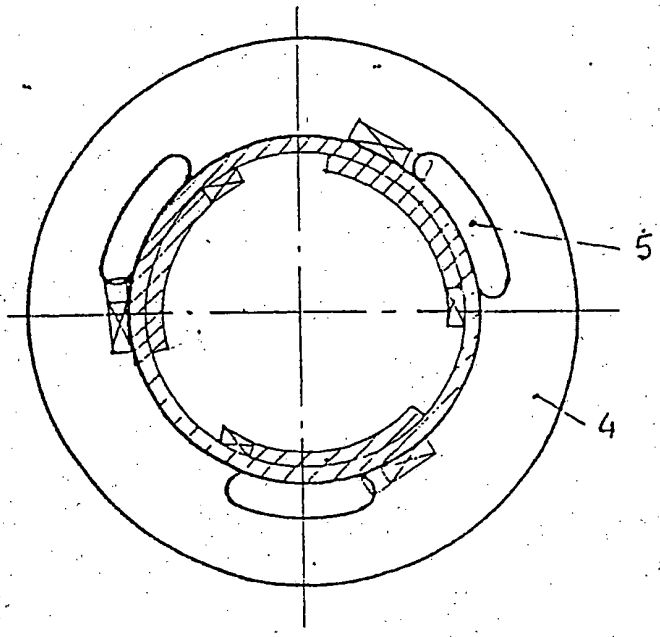
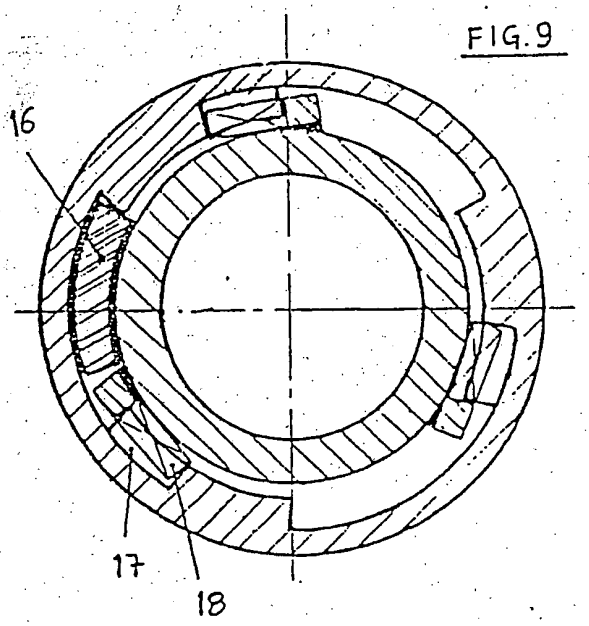


FIG. 9



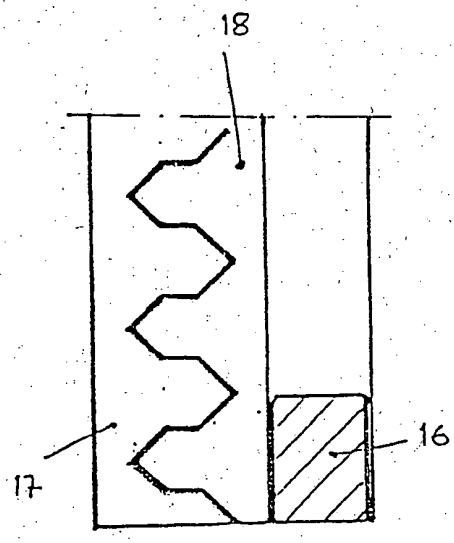


FIG. 10

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EUROPEAN SEARCH REPORT

Application Number

EP 88 83 0416

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	US-A-3 447 652 (J. TIPTON) * Abstract; column 3, lines 4-30; column 3, line 66 - column 5, line 62; figures 1,3-5,9 *	1,2	E 21 B 17/07
A	US-A-3 763 666 (F. TIBUSSEK) * Column 1, lines 35-62; column 2, lines 36-48; column 3, line 5 - column 4, line 25; figures 1-4 *	1	
A	US-A-3 255 612 (J. MAYER et al.) * Column 1, lines 8-43; column 4, line 39 - column 6, line 6; figures 1,4,5,8 *	1	
P,A	DE-U-8 714 200 (G. KLEMM) * Page 4, line 1 - page 5, line 10; page 9, line 31 - page 11, line 9; figures 1-3 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 21 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02-06-1989	RAMPELMANN K.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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